PATENT APPLICATION FOR UNITED STATES LETTERS PATENT

Video Recorder

Inventors:

Barrett Morris Kreiner

&

Joseph E. Page, Jr.

Bambi F. Walters

Scott P. Zimmerman

Walters & Zimmerman

P.O. Box 3822

Cary North Carolina 27519

(919) 387-6907

Attorney Docket Number: BS030265 (03-BS022)

TITLE OF THE INVENTION
Video Recorder

NOTICE OF COPYRIGHT PROTECTION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] This patent application relates to the co-pending and commonly-assigned United States Application No. XX/XXX,XXX (docket BS030144), filed September 30, 2003, and entitled "Video Recorder," of which the "Brief Summary Of The Invention" section and the "Detailed Description of the Invention" section are incorporated herein by reference.

[0003] This patent application also relates to the co-pending and commonly-assigned United States Application No. XX/XXX,XXX (docket BS030264), filed September 30, 2003, and entitled "Video Recorder," of which the "Brief Summary Of The Invention" section and the "Detailed Description of the Invention" section are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0004] This invention generally relates to image analysis and, more particularly, to image compression using adaptive coding.

2. Description of the Related Art

[0005] Prior art video security systems are not always effective. Whether the prior art video security system utilizes older, analog video cassette tapes, or more recent digital technologies, often times these prior art security systems do not capture important images that help resolve security situations. The older, analog video cassette-based systems, for example, produce hours of usually unimportant video. If a security situation arises, time and resources are squandered while the video tapes are manually reviewed for important information (*e.g.*, the identity of a thief). Even the newer, digital surveillance technologies, using computer intelligence to isolate "important events," often fail to capture information that can resolve security situations. By the time the computer intelligence has determined that something "important" is occurring, revealing information (such as the thief's face) has not been saved. There is, accordingly, a need in the art to capture video/audio data for improved surveillance needs, a need for producing surveillance data that does not require a large amount of time for manual review, and a need for improved recording of video and/or audio data that is compatible with digital technologies.

BRIEF SUMMARY OF THE INVENTION

[0006] The aforementioned problems, and other problems, are reduced by a video recorder. This invention provides methods, apparatuses, computer programs, and computer program products for digitally recording video and/or audio data of an event. This invention provides digital storage of visual and aural data for improved quality and for simplified manipulation. Because this invention provides digital storage, the video and/or audio data may be formatted and presented on many different hardware and software systems (*e.g.*, computers, personal digital assistants, cell phones, tablets, and other communications devices). The digital nature of the data may also be communicated in real-time, or near real-time, to monitoring agencies, law enforcement agencies/authorities, and other entities. This invention thus provides a simple, convenient, and effective means of storing and of communicating video and audio data.

[0007] The video recorder of this invention can record "backwards in time." That is, this invention provides time-delayed video and audio data. The video recorder stores video and audio

data in a loop buffer. The loop buffer stores video and audio data for a predetermined duration or elapse of time. Because the loop buffer stores anywhere from a few seconds to several minutes of video data, the loop buffer, at any one time, provides data from a time recently preceding the recorded event. The loop buffer thus provides both real-time and time-delayed video and audio data of the event captured by the camera. As this patent will further explain, this "time-delayed" video and audio data may be very useful for security and surveillance uses.

[0008]   This invention discloses methods and apparatuses for recording video data of an event. Some of the apparatuses include a video recorder. A processor communicates with memory. The memory stores video data of the event captured by a camera, and the video data includes a series of picture frames of the event. A loop buffer also stores video data of the event captured by the camera. A rule-based engine stored in the memory uses a set of rules to store the contents of the loop buffer in the memory. The video recorder utilizes the loop buffer to provide video data prior to the occurrence of the event.

[0009]   Other embodiments of this invention describe a method for recording video data of an event. Here video data of an event is stored, and the video data includes a series of picture frames. The video data of the event is also stored in a loop buffer. A set of rules is applied to transfer the contents of the loop buffer to the memory, wherein the method provides video data prior to occurrence of the event.

[0010]   Other systems, methods, and/or computer program products according to embodiments will be or become apparent to one with skill in the art upon review of the following drawings and detailed description. It is intended that all such additional systems, methods, and/or computer program products be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0011] These and other features, aspects, and advantages of the embodiments of the present invention are better understood when the following Detailed Description of the Invention is read with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic illustrating a video recorder according to embodiments of this invention;

FIG. 2 is a more detailed schematic of the video recorder shown in FIG. 1;

FIG. 3 is a schematic of a vehicle incorporating the video recorder shown in FIGS. 1 and 2; and

FIG. 4 is a flowchart illustrating a method for recording video data of an event.

DETAILED DESCRIPTION OF THE INVENTION

[0012] This invention now will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. These embodiments are provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those of ordinary skill in the art. Moreover, all statements herein reciting embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future (*i.e.*, any elements developed that perform the same function, regardless of structure).

[0013] Thus, for example, it will be appreciated by those of ordinary skill in the art that the diagrams, schematics, illustrations, and the like represent conceptual views or processes illustrating systems and methods embodying this invention. The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing associated software. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic,

through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the entity implementing this invention. Those of ordinary skill in the art further understand that the exemplary hardware, software, processes, methods, and/or operating systems described herein are for illustrative purposes and, thus, are not intended to be limited to any particular named manufacturer.

[0014]   FIG. 1 is a schematic illustrating a video recorder 10 according to embodiments of this invention. This invention provides methods, apparatuses, computer programs, and computer program products for recording video and/or audio data of an event. This invention provides digital storage of visual and aural data for improved quality and for simplified manipulation. Because this invention provides digital storage, the video and/or audio data may be formatted and presented on many different hardware and software systems (*e.g.*, computers, personal digital assistants, cell phones, tablets, and other communications devices). The digital nature of the data may also be communicated in near real time to monitoring agencies, law enforcement agencies/authorities, and other entities. This invention thus provides a simple, convenient, and effective means of storing and of communicating video and audio data.

[0015]   The video recorder 10 of this invention also provides time-delayed video and audio data. The video recorder 10 stores video and audio data in a loop buffer 14. The loop buffer 14 stores video and audio data for a predetermined duration or elapse of time. Because the loop buffer 14 stores anywhere from a few seconds to several minutes of video data, the loop buffer 14, at any one time, provides data from a time recently preceding the recorded event. The loop buffer 14 thus provides both real-time and time-delayed video and audio data of the event captured by the camera. As this patent will further explain, this "time-delayed" video and audio data may be very useful for security and surveillance uses.

[0016]   Those of ordinary skill in the art of computer programming will recognize computer processes/programs are depicted as process and symbolic representations of computer operations. Computer components, such as a central processor, memory devices, and display devices, execute these computer operations. The computer operations include manipulation of data bits

by the central processor, and the memory devices maintain the data bits in data structures. The process and symbolic representations are understood, by those skilled in the art of computer programming, to convey the discoveries in the art.

[0017]   FIG. 1 is a simplified componentry schematic of the video recorder 10. The video recorder 10 includes at least one processor 12, a loop buffer 14, and a set 16 of rules. The video recorder 10 stores video data 17 of an event captured by at least one camera 18. The video data 17 includes a series of picture frames. When this series of picture frames are sequentially reviewed, the video data 17 resembles a motion picture of the event. The video recorder 10 stores the video data 17 in one or more memory devices. The memory devices include a memory subsystem 20 (such as RAM memory 22), flash memory 24, and/or a peripheral storage device 26. The peripheral storage device 26 could include an optical storage device 28, a memory card 30, a removable flash memory storage device 32, or a mass-storage device 36. The peripheral storage device 26 could also include a magnetic storage device (not shown) for storing the video data of the event. As the at least one camera 18 captures and sends video data 17 of the event, the video recorder 10 stores the frames of the video data 17 in one or more of the memory devices.

[0018]   The video recorder 10 also includes the loop buffer 14. The loop buffer 14 also stores video data 17 of the event captured by the at least one camera 18. The loop buffer 14, however, provides time-delayed video data of the event. As those of ordinary skill in the art understand, the loop buffer 14 stores the video data 17 for a predetermined duration or elapse of time (typically from a few seconds to several minutes). This video data 17 is stored in a plurality of data registers. These data registers are coupled in series, such that an output of the first register is coupled to an input of the next register in the series. The video data 17 thus shuttles from one register to the next register, thus providing time to execute logical instructions concerning the video data. When the video data 17 reaches the last register in the series, the video data must either be saved/transferred to a more permanent memory device, or the video data must be discarded. Because the loop buffer 14 stores anywhere from a few seconds to several minutes of video data, the loop buffer 14 provides video data from a time recently preceding the recorded

event. As this patent will further explain, this "time-delayed" video data may be very useful for security and surveillance uses. Because, however, the operational and architectural concepts of loop buffers are known, this patent will not further describe the loop buffer 14. If the reader desires a more detailed explanation of loop buffers, the reader is invited to consult United States Patent 6,598,155 to Ganapathy *et al.* (July 22, 2003), of which the "Detailed Description of the Preferred Embodiment" section is incorporated herein by reference.

[0019] The video recorder 10 also includes the set 16 of rules. The set 16 of rules determines when to transfer the contents of the loop buffer 14 into one or more of the memory devices. The set 16 of rules are logical rules, and each rule describes an event, occurrence, or detection that causes the contents of the loop buffer 14 to be transferred into one or more of the memory devices. The set 16 of rules is shown residing in the memory subsystem 20. The set 16 of rules, however, could also additionally or alternatively reside in the flash memory 24 and/or any of the peripheral storage devices 26 (*e.g.*, the optical storage device 28, the memory card 30, the removable flash memory storage device 32, and/or the mass-storage device 36). When the set 16 of rules determines to transfer the contents of the loop buffer 14 into one or more of the memory devices, the memory devices then store time-delayed video data. This time-delayed video data precedes the event, occurrence, or detection that triggered the transfer. The contents of the loop buffer 14 thus contain video data that precedes the event, occurrence, or detection.

[0020] The video recorder 10 may be very useful for mobile transportation uses. If the video recorder 10 is installed in, or monitors, a vehicle (such as an automobile or a tractor-trailer), the time-delayed video data may be useful for security and for surveillance uses. The at least one camera 18, for example, could be oriented to view an interior and/or an exterior of the vehicle. The video recorder 10 stores video data 17 from the at least one camera 18 in one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The video recorder 10 also stores video data 17 from the at least one camera 18 in the loop buffer 14. The contents of the loop buffer 14 would contain video data that precedes the event, occurrence, or detection. The set 16 of rules define various events, occurrences, or detections that cause the contents of the loop buffer 14 to be transferred into one or more of the memory devices. Because the contents of the

loop buffer 14 contain video data that precedes the event, occurrence, or detection, the contents of the loop buffer 14 may help identify a thief, determine fault in an accident, or document a component failure.

[0021]   As FIG. 1 shows, the video recorder 10 could include an interface 38 with a vehicle controller 40.   Many vehicles and/or vehicle manufacturers use one or more controllers/computers to control performance of an automobile's engine, transmission, powertrain, electrical, chassis, and HVAC components. Sensors, switches, and actuators provide data to these controllers, and these controllers use this data to control emissions devices, cooling fans, ignition, air/fuel ratios, and many other performance variables. The vehicle controller 40 receives vehicular data 42, and the set 16 of rules specifies what vehicular data 42 causes a transfer of the contents of the loop buffer 14 into one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). This vehicular data 42 may include engine or powertrain management system information from an engine, electric motor, or transmission system of the vehicle. The vehicular data 42 may also include electrical management system information from an electrical system of the vehicle. The vehicular data 42 may also include chassis management system information from a chassis system of the vehicle.

[0022]   The term "vehicular data," as used herein, can be any signals or information used by the engine or powertrain management system. The vehicular data 42 may include any of the sensor, switch, or actuator data collected by the engine or powertrain management system. Those of ordinary skill in the art recognize there are many sensors, switches, and actuators used in automobiles, and the number of sensors, switches, and actuators grows each model year. The vehicular data may include, for example, air intake temperature sensors, engine coolant sensors, throttle position sensors, manifold air pressure sensors, oxygen sensors, mass air flow sensors, ignition sensors, knock sensor, EGR sensors, and many other sensors. The set 16 of rules could specify what signals, information, and other vehicular data are used to transfer the contents of the loop buffer 14 into one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). Because the contents of the loop buffer 14 contain video data that precedes the event,

occurrence, or detection, the contents of the loop buffer 14 may help identify a thief, determine fault in an accident, or document a component failure.

[0023] The term "vehicular data" may also include any error codes flagged by the engine or powertrain management system. Sensors, switches, and actuators, as mentioned above, provide data to one or more on-board controllers/computers. These controllers/computers use this data to control emissions devices, cooling fans, ignition, air/fuel ratios, and many other components and performance variables. When these controllers/computers detect sensor inputs, or other inputs, that are outside of programmed limits, the controllers/computers often set an error code. The set 16 of rules could specify what error codes, signals, information, and other vehicular data are used to trigger a transfer the contents of the loop buffer 14 into one or more of the memory devices. Because the loop buffer 14 contains video data that precedes the transfer, the contents of the video buffer 14 may help determine what caused the error code.

[0024] The term "vehicular data" may also include electrical management system information. The electrical management system information includes information used to control the vehicle's electrical system. Sensors, switches, and actuators provide data to one or more on-board controllers/computers, and these controllers/computers use this data to detect under and over voltage or current conditions, open circuit conditions, circuit failures, power failures, battery failures, and many other electrical system concerns. The set 16 of rules could specify what electrical management system information and other vehicular data are used to trigger a transfer of the contents of the loop buffer 14 into one or more of the memory devices. Because the loop buffer 14 contains video data that precedes the transfer, the contents of the video buffer 14 may document any recently preceding event.

[0025] The term "vehicular data" may also include chassis management system information. Today's vehicles are increasingly using one or more controllers/computers to control advanced chassis/suspension components. Hydraulic and/or pneumatic leveling systems, adaptive/active suspension systems, magneto-rheological suspension components, electric steering systems, and four wheel steering systems are just a few of the technological advances in chassis design. These

chassis advances use one or more controllers/computers to control these systems. Steering wheel angle sensors, yaw, pitch, and roll accelerometer sensors, height sensors, shock absorber valving sensors, and many other chassis sensors, switches, and actuators are used to detect the state of the chassis system. The set 16 of rules could specify what chassis management system information and other vehicular data 42 are used to trigger a transfer of the contents of the loop buffer 14 into one or more of the memory devices. Because the loop buffer 14 contains video data that precedes the transfer, the contents of the video buffer 14 may document any recently preceding event.

[0026] The video recorder 10 of this invention, as mentioned above, is useful for security and for surveillance uses. The set 16 of rules specifies the conditions, events, errors, or signals that trigger a transfer of the contents of the loop buffer 14. When the set 16 of rules triggers a transfer of the contents of the loop buffer 14, the video data may be useful in identifying a thief, determining fault in an accident, or documenting a component failure. The vehicle controller 40, for example, may detect movement of a door latch. If this movement, however, is not accompanied by digital authorization from a wireless key fob, the movement may indicate an attempted vehicle theft. The set 16 of rules, then, could specify that when door latch movement is detected, yet unaccompanied by digital authorization from a wireless key fob, the contents of the loop buffer 14 should be transferred to a more permanent memory device (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The video data 17 captured by the at least one camera 18 may help identify the potential thief.

[0027] The video recorder 10 of this invention could also help determine fault in an accident. The vehicle controller 40 may detect accelerometer sensor data, detonation, or other indicator of an airbag deployment. The set 16 of rules could specify that when the airbag is deployed, the contents of the loop buffer 14 should be transferred to one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The video data 17 captured by the at least one camera 18 may thus help determine from what direction the vehicle was heading, the climatic and road conditions, the surrounding traffic situation, and, ultimately, who was a fault.

[0028] The video recorder 10 may similarly help resolve product liability issues. When product liability cases are brought against a manufacturer, causation is often debated — was the accident caused by operator error or by component failure? The video recorder 10 of this invention may help resolve causation and other product liability issues. The vehicle controller 40, for example, may detect unusually high accelerometer data. This unusually high accelerometer data may indicate full jounce/rebound movement of a suspension component and/or excessive yaw, pitch, or roll movement. The set 16 of rules could specify that when unusually high accelerometer data is detected, the contents of the loop buffer 14 should be transferred to one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The video data 17 captured by the at least one camera 18 may then help determine whether a suspension component failed and caused the vehicle to rollover, or whether the operator drove onto the curb and caused the vehicle to flip.

[0029] The video recorder 10 also includes a switch 44. The switch 44 may be used to manually trigger a transfer of the contents of the loop buffer 14 into one or more of the memory devices. The switch 44 could be placed in proximity to the operator of the vehicle or in proximity to a passenger. When the driver or the passenger witnesses an event worthy of more permanent storage, the driver and/or passenger can depress/toggle/activate the switch 44. The driver, for example, may witness an accident, drunken driver, altercation, or rare moment. The set 16 of rules could specify that when the switch 44 is activated, the contents of the loop buffer 14 should be transferred to one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The video data 17 captured by the at least one camera 18 may then document from a time preceding the accident, drunken driver, altercation, or other moment.

[0030] The video recorder 10 may also include a microphone 46. The microphone 46 provides audio data 48 of the event. This audio data 48 may also be stored in the loop buffer 14. When the set 16 of rules specifies, the audio data 48 is transferred to one or more of the memory devices (*e.g.*, 20, 22, 24, 26, 28, 30, 32, and/or 36). The term "microphone" includes any means for transferring sound/pressure into electrical signals.

12

[0031] The video recorder 10 may also include an interface 50 to a communications network 52. This interface 50 allows the video recorder 10 to transfer the contents of the loop buffer 14 to a remote location. The interface 50 could include a physical connection (e.g., a wire, optical fiber, or cable connection) to the communications network 52. The interface 50, however, may also utilize a wireless protocol to a wireless communications network. Wireless networks, such as those utilizing the I.E.E.E. 802 family of wireless standards, could be used to transfer the contents of the loop buffer 14 to one or more remote memory locations. The video recorder 10, for example, could transfer the contents of the loop buffer 14 to any of the peripheral storage devices 26 (e.g., the optical storage device 28, the memory card 30, the removable flash memory storage device 32, and/or the mass-storage device 36) via the wireless interface 50 to the communications network 52. When the video recorder 10 comes within range of a wireless network (e.g., a "Wi-Fi" network), the set 16 of rules could specify that the contents of the loop buffer 14 be wirelessly transferred to any of the peripheral storage devices 26.

[0032] The video recorder 10 may also tag the video data 17 with metadata 53. The term "metadata" describes any data, description, narration, or explanation of other data. Here the set 16 of rules video recorder 10 may add, append, supplement, or tag the video data 17 with metadata. The metadata 53 may be any information, such as a description of a rule that caused the contents of the loop buffer 14 to be transferred to at least one of the memory devices 20, 22, 24, 26, 28, 30, 32, and/or 36.

[0033] FIG. 2 is a more detailed schematic of the video recorder 10. The video recorder 10 includes the one or more processors 12 executing an operating system. The operating system, as is well known, has a set of instructions that control the internal functions of the processors 12 and of other components. A system bus 54 communicates signals, such as data signals, control signals, and address signals, between the processor 12 and a system controller 56 (typically called a "Northbridge"). The system controller 56 provides a bridging function between the one or more processors 12, the memory subsystem 20, and a PCI (Peripheral Controller Interface) bus 58. The PCI bus 58 is controlled by a Peripheral Bus Controller 60. The Peripheral Bus Controller 60 (typically called a "Southbridge") is an integrated circuit that serves as an

input/output hub for various peripheral ports. These peripheral ports could include, for example, a keyboard port 62, a mouse port 64, a serial port 66 and/or a parallel port 68 for a video display unit, one or more external device ports 70, and networking ports 72 (such as SCSI or Ethernet). Those of ordinary skill in the art understand that the program, processes, methods, and systems described in this patent are not limited to any particular computer system or computer hardware.

[0034]   Those of ordinary skill in the art also understand the at least one processor 12 is typically a microprocessor. Advanced Micro Devices, Inc., for example, manufactures a full line of ATHLON™ microprocessors (ATHLON™ is a trademark of Advanced Micro Devices, Inc., One AMD Place, P.O. Box 3453, Sunnyvale, California 94088-3453, 408.732.2400, 800.538.8450, www.amd.com). The Intel Corporation also manufactures a family of X86 and P86 microprocessors (Intel Corporation, 2200 Mission College Blvd., Santa Clara, California 95052-8119, 408.765.8080, www.intel.com). Other manufacturers also offer microprocessors. Such other manufacturers include Motorola, Inc. (1303 East Algonquin Road, P.O. Box A3309 Schaumburg, IL 60196, www.Motorola.com), International Business Machines Corp. (New Orchard Road, Armonk, NY 10504, (914) 499-1900, www.ibm.com), and Transmeta Corp. (3940 Freedom Circle, Santa Clara, CA 95054, www.transmeta.com). Those skilled in the art further understand that the program, processes, methods, and systems described in this patent are not limited to any particular manufacturer's central processor.

[0035]   The preferred operating system is the UNIX® operating system (UNIX® is a registered trademark of the Open Source Group, www.opensource.org). Other UNIX-based operating systems, however, are also suitable, such as LINUX® or a RED HAT® LINUX-based system (LINUX® is a registered trademark of Linus Torvalds, and RED HAT® is a registered trademark of Red Hat, Inc., Research Triangle Park, North Carolina, 1-888-733-4281, www.redhat.com). Other operating systems, however, are also suitable. Such other operating systems would include a WINDOWS-based operating system (WINDOWS® is a registered trademark of Microsoft Corporation, One Microsoft Way, Redmond WA 98052-6399, 425.882.8080, www.Microsoft.com). and Mac® OS (Mac® is a registered trademark of Apple Computer, Inc., 1 Infinite Loop, Cupertino, CA 95014, 408.996.1010, www.apple.com). Those of ordinary skill

in the art again understand that the program, processes, methods, and systems described in this patent are not limited to any particular operating system.

[0036] The memory devices (shown as reference numerals 20, 22, 24, 26, 28, 30, 32, and/or 36 in FIGS. 1 and 2) may also contain an application program. The application program cooperates with the operating system and with a video display unit (via the serial port 66 and/or the parallel port 68) to provide a Graphical User Interface (GUI). The Graphical User Interface typically includes a combination of signals communicated along the keyboard port 62 and the mouse port 64. The Graphical User Interface provides a convenient visual and/or audible interface with a user of the video recorder 10.

[0037] The video recorder 10 may include other componentry. The video recorder 10, for example, may include a video digitizer. This video digitizer would convert analog video data from the at least one camera (shown as reference numeral 18 in FIG. 1) to digital video data. The video recorder 10 may also include video encoding software. This video encoding software is also stored in at least one of the memory devices (shown as reference numerals 20, 22, 24, 26, 28, 30, 32, and/or 36 in FIGS. 1 and 2), and the video encoding software formats the video data transferred from the loop buffer 14. The video data, for example, may be formatted according to an MPEG standard or any other standard. The video recorder 10 may also include encryption software for encrypting the video/audio data before storing in at least one of the memory devices. Encryption may be desirable before remotely storing the video data via the communications network 52.

[0038] FIG. 3 is a schematic of a vehicle 74 incorporating the video recorder 10. The vehicle 74 includes a powertrain system 76 driving at least one wheel and tire assembly 76. The powertrain system 76 typically includes an internal combustion engine coupled to a transmission, and the transmission couples to the at least one wheel and tire assembly 76. The powertrain system 76, however, may additionally or alternatively include an electric motor driving the at least one wheel and tire assembly 76. The powertrain system 76 additionally or alternatively may include fuel cell device. Because the powertrain system 76 may have many different

configurations, FIG. 3 schematically represents the powertrain system 76 as a generic block. Although the powertrain system 76 may have a front-wheel drive configuration, a rear-wheel drive configuration, or an all-wheel drive configuration, FIG. 3 shows the powertrain system 76 coupled to a rear wheel 78. This coupling between the powertrain system 76 and the rear wheel 78 is shown as a dotted line arrow labeled "Coupling" (shown as reference numeral 80).

[0039]   FIG. 3 also shows the vehicle controller 40. The vehicle controller 40 receives the vehicular data 42 from the powertrain system 76. Although not shown in FIG. 3, the vehicle controller 40 may additionally or alternatively receive the vehicular data 42 from a chassis component, sensor, or controller and/or an electrical system component, sensor, or controller. The interface 38 between the video recorder 10 and the vehicle controller 40 allows the video recorder 10 to make decisions based upon the vehicular data 42.

[0040]   The video recorder 10, as mentioned above, stores video data of an event. The video recorder 10 receives the video data and/or the audio data (shown, respectively, as reference numerals 17 and 48 in FIG. 1) from the at least one camera 18 and from the microphone 46. When the set 16 of rules specifies, the video recorder 10 transfers the contents of the loop buffer 14 to at least one of the memory devices (shown as reference numerals 20, 22, 24, 26, 28, 30, 32, and/or 36 in FIGS. 1 and 2). The video recorder 10 may utilize the wireless interface 50 to transfer the contents of the loop buffer 14 to one or more remote memory locations via the communications network 52. The contents of the loop buffer 14 may then be used to view video and audio data recently preceding an event.

[0041]   FIG. 4 is a flowchart illustrating a method for recording video data of an event. Video data of an event, captured by a camera, is received at a video recorder (Block 82). The video data includes a series of picture frames. The video recorder may also receive audio data of the event captured by a microphone (Block 84). If the video is in an analog form (Block 86), the video is digitized (Block 88). The video data is stored in memory (Block 90) and stored in a loop buffer (Block 92). A set of rules is applied to transfer the contents of the loop buffer to the memory (Block 94). The video recorder may also interface with a switch to manually transfer the

contents of the loop buffer to the memory (Block 96). The video recorder may also interface with a vehicle controller to transfer the contents of the loop buffer to the memory (Block 98). The video recorder may tag the video data with metadata (Block 100). The metadata provides a description of a rule that caused the contents of the loop buffer to be transferred to the memory. If remote storage is desired or required (Block 102), the contents of the loop buffer are transferred via a communications network (Block 104). The contents of the loop buffer may be transferred to an optical storage device, a flash memory storage device, a magnetic storage device, and/or another mass-storage device (Block 106).

[0042] The set 16 of rules may be physically embodied on or in a computer-readable medium. This computer-readable medium may include CD-ROM, DVD, tape, cassette, floppy disk, memory card, and large-capacity disk (such as IOMEGA®, ZIP®, JAZZ®, and other large-capacity memory products (IOMEGA®, ZIP®, and JAZZ® are registered trademarks of Iomega Corporation, 1821 W. Iomega Way, Roy, Utah 84067, 801.332.1000, www.iomega.com). This computer-readable medium, or media, could be distributed to end-users, licensees, and assignees. These types of computer-readable media, and other types not mention here but considered within the scope of the present invention, allow the set 16 of rules to be easily disseminated. A computer program product for transferring video and/or audio data from a video recorder to memory comprises the computer-readable medium and the set 16 of rules. The set 16 of rules is stored on the computer-readable medium.

[0043] The set 16 of rules may also be physically embodied on or in any addressable (*e.g.*, HTTP, I.E.E.E. 802.11, Wireless Application Protocol (WAP)) wireless device capable of presenting an IP address. Examples could include a computer, a wireless personal digital assistant (PDA), an Internet Protocol mobile phone, or a wireless pager.

[0044] While the present invention has been described with respect to various features, aspects, and embodiments, those skilled and unskilled in the art will recognize the invention is not so limited. Other variations, modifications, and alternative embodiments may be made without departing from the spirit and scope of the present invention.